

Human Health Risk Assessment

Products and Outputs in FY17
Project 6: Cumulative Risk Assessment (CRA)
Methods and Applications
Task 4: Apportioning Multimedia Exposure and Risk
Across Receptors

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APPORTIONING MULTIMEDIA EXPOSURE AND RISK ACROSS HUMAN AND ECOLOGICAL RECEPTORS

CONTACT: JEANETTE REYES (ORISE AT NCEA-RTP)

Purpose:

This research supports ORD by developing state-of-the-art methods for human health risk assessment that will inform NCEA assessments and are simple and cost-effective for our partners at State and Local Agencies to apply.

Impact and Use:

The novel methodology developed through this project allows for quantification of risk associated with chemical exposures in which control of a single pollutant or of multiple co-pollutants impacts human health. This method will be directly useful for State and Local partners to minimize costs by focusing on the most impactful pollutant control strategies.

Description:

Several approaches may be used to inform the quantification of risk to chemical mixtures. A cumulative risk approach assesses the risk associated with exposure to multiple chemicals. This analysis evaluates two approaches, the Hazard Index/Hazard Quotient and Maximum Cumulative Ratio, to quantify the potential of concern over chemical co-exposures, using phthalate exposures as an example. This work falls under Project 6 (Cumulative Risk Assessment [CRA] Methods and Applications), Task 4 (Apportioning Multimedia Exposure and Risk across Receptors).

Outputs:

2 related papers, 2 presentations and 1 award

Reyes, J. M.; Price, P. S. Temporal trends of cumulative risks from phthalates in biomonitoring data. *Environ. Sci. Technol.* **2018**, in preparation.

Reyes, J.; Price, P. An analysis of cumulative risks based on biomonitoring data for six phthalates using the Maximum Cumulative Ratio. *Environ. Int.* **2017**, under review.

Reyes, J. and Paul Price, **2017**. Trends in Cumulative Exposures of Six Phthalates in the United States from 2005 to 2014, International Society of Exposure Science, Oral Presentation. RTP, NC, USA. October 19.

Reyes, J. and Paul Price, **2017**. An Analysis of Cumulative Risks Indicated by Biomonitoring Data of Six Phthalates Using the Maximum Cumulative Ratio, Society of Toxicology, Poster Presentation. Baltimore, MD, USA. March 16. [**Top 5 Mixtures Specialty Section Abstracts Award**]

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HAZARD INDEX (HI) AND HAZARD QUOTIENTS (HQs) OVER TIME

Description

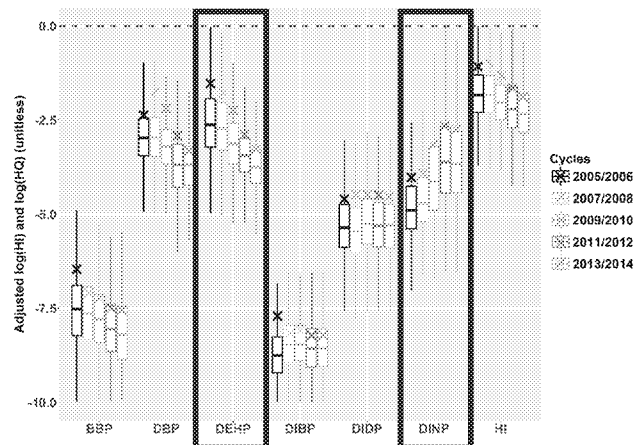
- Using six phthalates as a case study, population-wide temporal trends of HI are investigated for the past decade from the NHANES data set. HQ compares pollutant exposure to a reference value, and HI sums HQ across pollutants.

Results

- There was a sizable decrease in hazard from 2005-2014 in terms of percentage of participants with HIs of concern (5.1% to 0.8%) and mean hazard (0.34 to 0.15).
- Temporal trends show a decrease in DEHP hazards with increases in DINP hazards.

Impact

- Investigating population-wide hazards can be a means to prioritize co-exposures to chemicals of interest for epidemiological and toxicological studies of phthalate mixtures.
- Monitoring of phthalates continues to be important as mitigation strategies change, new phthalates enter the market, and population-wide hazards decrease.



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HAZARD INDEX (HI) AND MAXIMUM CUMULATIVE RATIO (MCR) OVER TIME

Description

- MCR measures the dominance of a single chemical within a mixture, defined as hazard divided by the maximum individual chemical-specific hazard.

Results

- Mean MCR consistently increases over time, indicating that mixtures are less dominated by individual chemicals.

Impact

- The MCR metric can be a means to prioritize by how much individual chemicals within a group affect hazard, especially among hazards of concern.
- An increasing MCR among phthalates demonstrates that as overall hazards decrease, remaining hazards of concern will only be properly identified through an investigation of mixtures.

